

IsoTek SMART Power

Product Overview

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A PROBLEM TO ADDRESS

The decision to commence development of a range of custom installation products was born out of the observation that installers do not have a designed for task, built for purpose, power management, control and distribution system which specifically addresses the performance needs of home cinema or home audio installation.

The developed electronics should also provide an intuitive user and installer-facing interface which provides programmability, sequential start up control, socket identification with timed events combining stand-by power saving as well as reporting logs of power related issues. The control system should be built from an RS232 base and support drivers / modules for Control 4, Crestron, Elan, RTI and other home automation systems.

The system should also offer remote accessibility, supporting modern electrical communication devices, be these office based PCs or mobile devices. Installers should be able to access the installation, with the owners consent, remotely from their office, carry out maintenance and if necessary re-boot components, thus not only time is saved through unnecessary travel but a greater degree of customer support reached.

The system should address the importance of the power supply chain, which is generally not fully considered by installers or given the critical attention needed. Not enough emphasis is placed on this critical area of installations; more often than not power distribution products are used from other industries in ad hoc combinations to provide a fix. Whilst a solution to some extent is reached, that solution is less than ideal for reliability or performance. In short, most outcomes are not fully fit for purpose or fully address performance criteria, which should be a primary motivator and driving force for a high-end, high cost audio or audio-visual installation.

Installers are forced to take devices from other industries, with suitability being questionable, in order to find power management and power installation solutions. Generally IT based products are specified for power distribution with a degree of programmable control, but they are not fully fit for the task in question. They are placed in an environment that they were not designed to serve, resulting in non-ideal outcomes. Whilst a fix is found, this fix to offer a level of control or remote access does not fully address suitable levels of protection and is not specifically designed for audio or audio-visual purposes, doing nothing to remove mains born contamination. It does not consider the high amperage or high transient power demands of audio or audio-visual electronics.

Critical areas of mains purity are totally overlooked, with no emphasis given to the removal of either Differential Mode or Common Mode mains distortions (Differential Mode noise, which is created by the power supplies within electrical equipment, and Common Mode noise by wireless control systems or radio frequencies).

In essence any installation will result in the placement of multiple electrical products in a confined and localized area, often rack mounted. In this environment high levels of Differential Mode noise will be produced, and thus performance will be heavily compromised. Given the fact that these electronics have been carefully specified to deliver an enhanced audio or audio-visual experience for the owner, it seems unforgivable to hold back performance because of a poor mains power quality. Without correctly addressing the power to these sophisticated electronics, performance and reliability is greatly compromised. Moreover, by sheer virtue of an installation, there is an increased risk created by high levels of Differential Mode distortions and mains noise due to the shared and localized power supply.

BACKGROUND INFORMATION

POWER

There are many factors that affect the purity of the mains supply. From the moment power is generated it is exposed to many polluting factors. In addition to mains noise and distortion the original network used to transport electricity is, in many cases, old and does not operate as efficiently as it once did. The distribution network has been added to, extended and expanded, therefore maintaining a tightly regulated 230V / 50Hz mains, is more a dream than a reality. Power networks are placed under increasing strain as people become reliant on more electrical devices. General mains quality is continually compromised, it is not ideal before entering a home or being used to power large scale electrical installations.

In general terms mains distortion can be broken down into two key areas, Differential Mode and Common Mode noise. Whilst there is much debate relating to Differential Mode noise, in general terms this interference is caused by an out of phase switching action, equal and opposite noise spikes usually with perfect symmetry appearing on both live and neutral wires of the electrical supply. This being generated by electrical equipment as it draws power. Switching power supplies, which are heavily promoted to conserve power, create higher levels of distortion due to the continual sampling of the mains sine wave. Common Mode noise has historically been created by radio frequency interference, however as we increase cellular networks and wireless communication Common Mode issues also increase. Common Mode noise interference results with in-phase waveforms arriving on live, neutral and earth. If displayed on an oscilloscope all of the waveforms are shown as identical.

INSTALLATION

Any installation by sheer virtue of the task involved results in multiple electrical devices being placed and connected together in a localised environment, with a single shared power line distributed through general purpose power bars or perhaps an IT based power supply unit (PSU), should functional control be required. As a result multiple devices are installed, all independent yet serving a common group of components. In large installations multiple audio zones, or visual zones are placed within premises, but the power or the independent control of these zones is not possible. So whilst a power distribution solution is reached, the result unfortunately is a compromise in full system control as well as programmability, reductions in overall performance due to heavy levels of Differential Mode noise created by equipment, and Common Mode noise, created by the network. There is no consideration given to performance robbing distortion, or the cross contamination of that distortion across multiple outlets sockets which are connected in series, thus noise is transported from one connected electrical device to the next. In essence a PSU designed for computer networking isn't going to be an ideal PSU for the demands of audio or audio-visual electronics, where internal wiring, circuit board architecture, impedance, transient amperage and power delivery should be given consideration.

If installers are forced to implement multiple power devices, all independent yet trying to provide a global power solution the potential for network failure also increases. Considering the control interface from an after sales service perspective it is unlikely that there is consistence from one install to the next. Remote access and servicing would also be questionable.

FULL SYSTEM SOLUTION

CONTROL

The IsoTek Delta is a sleek 2U (89mm) high rack width component, offering full system control of connected electronics through RS232, LAN and over WiFi and full power cleaning to sixteen C14 IEC power output sockets.

A special ATMEL processor that contains 128bit hardware encryption has been used for security within the communication circuit. The unit can be programmed and controlled using RS232 via traditional and USB ports, or via a web based secure interface. Specific Codex are also being developed to support Control 4, Crestron RTI, URC and Elan. LAN Ethernet port for WiFi control with antenna also feature.

Installing the Delta SMART power device into an installation is quick, easy and intuitive. After unboxing and installing the Delta in either a rack mount enclosure or rack based environment, connect power cords and a LAN Ethernet cable, this should be connected directly to your router. Connect components into the output sockets via the power cables. RS232, and Micro USB ports are also available for installation programmability, if required.

Turn on via the power button at the rear of the unit. The Delta SMART power product will sequentially start up each output socket. A quick secure web based interface allows installers to label each output socket with the connected electronics, set sequential delay times between each outlets, outlets can be locked to preserve their settings, or switched to router control to avoid being turned off. The programmed event interface lets users set timed turn on or turn off of individual power outlets. Within this same environment master and slave socket functions can also be programmed allowing for energy saving. For example, setting a connected TV as master, with a less than 10W trigger additional slave sockets can be triggered to turn off, thus removing stand-by power.

For larger scale installations single units can be grouped together to act as one. This gives installers flexibility when multiple power outlets are required, for example 16+. Two Delta products could be grouped and named, 'Home cinema basement' resulting in two units becoming one in function and sequential power down or power up.

The logs area provides power usage reports, which can be downloaded as PNG, JPG, PDF, SVG, CSV, and XLS formats allowing flexibility of report generation.

Once connected to an IsoTek SMART product installers will not only have complete remote control over multiple installations but also be advised if the device is off line, perhaps through a power outage, and for the exact time duration.

Great care has been given to making installations simple, effective and without the need to solve difficult IT related issues. The IsoTek 'SMART' solution is not dependent upon a network infrastructure, the method of communication does not require any additional setting or configuration changes to a domestic network or dealing with public IP addresses of a customer's network operator. The solution works in any network irrespective of its structure or the network operator. An installer connects the device and the device is fully functional in an instant and available for after sales support or office based log-in irrespective of location. For example one could be located in England but overview customer logs, reboot or control functions of a unit placed on a domestic network, behind a router in ASIA. Remote login being with customer granted consent within the control system.

Delta offers, remote login support, so systems can be overviewed without travel or loss of time. Control via cellphone, tablet, PC (from an location in the world). Accurate multi-channel

power consumption and voltage measurement, schedulers for timed turn-on turn-off, master slave stand-by power saving. The communication system of the IsoTek SMART power products is protected by cyclic floating-point encryption with random initialisation vector in each data packet, which includes a dynamic key change.

POWER CLEANING & PROTECTION

Delta protects equipment up to 54000A using a multiple array of VDRs to react instantaneously if required. A dedicated filter network design to eliminate Differential and Common Mode mains noise, providing each output socket with independently cleaned power this also avoids mains noise cross contamination between connected electronics.

As previously stated any installation consists of multiple electrical devices in a common environment with localised power. Each electrical component will create Differential Mode noise, and this distortion will be transferred to all components because of the architecture of the general-purpose power supply unit.

The Delta SMART Power filter configuration in a CLC structure where C is capacitance and L is inductance. The inductance is in Common Mode and is of specific bespoke design. The final part of the filter is many separated capacitors to offer better component-to-component filtering. This network follows the IsoTek philosophy of ground and phase separated distribution. Each capacitor is positioned within the circuit designed to electrically appear directly on each output terminal. Each socket is independently wired back to the PCB and filter network, not directly connected in series. Thus cross contamination of Differential Mode noise created by connected electronics is significantly reduced and removed. At the heart of the filter network is a large bespoke Common Mode choke with two windings in opposite phase, live and neutral going to their separate coils. The current draw flows through both windings, causing magnetic flux in the opposite direction and results in almost zero inductivity. Due to the resulting flux of the current being zero, the choke will not go into magnetic saturation under normal operating conditions. This results in the 50/60 Hz flow being almost completely balanced making the choke electrically invisible. The Ultra high frequency Delta filtering is at Mobile phone frequencies from Live to Earth and Neutral to Earth. Class Y devices being used.

To maintain high levels of amperage and low levels of resistance, four times general standard, the Delta PCB features a 70 micro metre thick copper layer of 4Oz. Very low levels of DC resistance are also maintained for not only safety but also sound performance quality. Circuit and switching are of the highest grade, with a lowest resistance path to the output power sockets. So that the measurement and control circuits are accurate and not influenced by the high levels of power Silicon Labs Si86xx isolators are used for both separation and safety. These offer highly reliable, high-speed operation for demanding applications with isolation ratings up to 5kV. These isolators also offer superior isolation properties using CMOS capacitor couplings which can be 10 times more effective over opto couplers using plastic film separation exactly like a class X capacitor. The silicon semiconductor offers a world-class dielectric from voltage point of view and extrapolated performance of this range is as much as 60 continuous years at 400 Vrms. 253Vrms is the regulation maximum. The switching circuit itself, within the product, uses special chips in combination with both current and voltage transformers for accurately measuring power. The switching circuit is executed by power relays, and the switching power supply has also been fully shielded and carefully located in a area of the chassis to prevent penetration of electro magnetic interference which would effect the measurement accuracy.

Finally the Delta SMART product features high-grade internal wiring. Both solid core Ohno continuous cast copper silver plated conductors with virtual air dielectric in combination with 2sqmm 6n OFC silver plated wire with FEP dielectric.

CONCLUSIONS

From the research undertaken it becomes clear that more emphasis should or needs to be placed on power management electronics designed correctly for the environment that they are set to serve. Especially so in the area of custom installation, projects relating to audio and audio-visual application. An installer could be referred to as the architect, responsible for many areas with critical judgments being made for each component in the overall solution. It would however be a very foolish architect to prioritise a roof top swimming pool over or instead of correct and suitable building foundations.

It is unfortunately the case that what is not understood is often dismissed. Installers rightly focus on system solutions, however the choice of system control hardware needs greater thought. Whilst a fix can be found, the suitability, from a performance perspective is often dismissed. A cup will hold liquid, but there are reasons why glasses are also made, some for wine and some for beer. Customers investing multiple 10s or 100s of thousands in performance oriented systems should specify the right, and appropriate power management system.

The aim of the SMART range of power products from IsoTek, of which the Delta is one, was to delivery to the market a properly designed power cleaning system, design based upon almost two decades of experience in the specialist two channel audio market, combined with an intuitive easy to understand interface which offers easy to set up system control and system power management. Using Delta requires no special network or IT training, the unit can be installed, set-up and programed within minutes. System administration, after sales support can be handled securely, quickly and easily. Delta is an effective commonsense product designed to offer a practical and performance driven solution in an area which is unfortunately poorly serviced.